AMENDMENT

The listing of the claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-19 (canceled)

Claim 20. (new) A method of monitoring the condition of a semiconductor wafer surface, comprising the steps of:

rotating a first sensor about a platen axis at a platen angular velocity ω_p;

rotating the wafer about a wafer axis at a wafer angular velocity ω_w that is not equal to ω_p, thereby allowing the sensor to scan the surface in a pattern that comprises a plurality of loci;

collecting a surface reflectance datum from the sensor at each of a plurality of points along each loci;

mapping the surface reflectance data to one or more localized zones on the surface; and

characterizing the condition of the surface in each of the localized zones based on one or more statistical measures for the reflectance in the zones.

Claim 21. (new) The method of Claim 20, wherein the loci are substantially uniformly distributed across the surface.

Claim 22. (new) The method of Claim 20, wherein the sensor is located a distance r_s from the platen axis, the platen axis is displaced from the wafer axis by a distance r_{cc}, and $r_s \neq r_{cc}$.

Claim 23. (new) The method of Claim 22, wherein a second sensor located at a distance $r_{s,2}$ from the platen axis is rotated about the platen axis at angular velocity ω_p, and the surface reflectance data are collected from the first and second sensors.

Claim 24. (new) The method of Claim 23, wherein r_s and $r_{s,2}$ are not collinear.

Claim 25. (New) The method of Claim 20, wherein the platen axis and wafer axis are translated at a non-zero relative sweeping velocity $\dot{r}_{cc}$ that is perpendicular to both of the axes.

Claim 26. (New) A chemical mechanical polishing (CMP) apparatus comprising:

a polishing platen that rotates around a platen axis at a platen angular velocity ω_p;

a sensor located on the platen and located at a sensor radius r_s from the platen axis;

a wafer carrier for holding a wafer in cooperative relationship with the rotating platen while rotating the wafer around a wafer axis at a wafer angular velocity ω_w that is not equal to ω_p, thereby allowing the sensor to scan the surface in a pattern that comprises a plurality of loci, wherein the loci are substantially uniformly distributed across the surface, the wafer carrier having multiple chambers that allow for independently varying pressure within the chambers that urge against the wafer at corresponding multiple localized zones on the wafer; and

a process controller configured to record a surface reflectance datum from the sensor at each of a plurality of points along each loci and maps the surface reflectance data to the localized zones on the surface.

Claim 27. (new) The CMP apparatus of Claim 26, wherein the wafer axis and the platen axis are displaced by a distance r_{cc} and $r_s \neq r_{cc}$.

Claim 28. (new) The CMP apparatus of Claim 26, wherein the mapped surface reflectance data are used to control the polishing independently within each of the multiple localized zones.

Claim 29. (new) The CMP apparatus of Claim 26, wherein the mapped surface reflectance data indicate the state of polishing of the wafer within each of the multiple localized zones.

Claim 30. (new) The CMP apparatus of Claim 26, wherein the process controller is further configured to process the mapped surface reflectance data to determine the state of polishing within each of the localized regions, and to selectively vary the pressure independently within each of the multiple chambers responsive to the state of polishing determination.

Claim 31. (new) The CMP apparatus of Claim 26, wherein the multiple chambers are formed in a flexible membrane and comprise a center chamber surrounded by one or more concentric chambers.

Claim 32. (new) The CMP apparatus of Claim 26, wherein the multiple chambers comprise a center circular chamber and three annular, concentric chambers.

Claim 33. (new) The CMP apparatus of Claim 26, wherein the sensor comprises at least one fiber optic sensor having a bundle of transmit and receive optical fibers terminating at a sensor tip, a light source which transmits light through the transmit optical fibers to the surface of the wafer, and a photodetector which receives reflected light from the surface of the wafer through the receive optical fibers.

Claim 34. (new) The CMP apparatus of Claim 33, wherein the transmit and receive optical fibers are oriented substantially normal to the surface of the wafer.

Claim 35. (new) The CMP apparatus of Claim 33, wherein the sensor tip is spaced apart from the surface of the wafer to form a gap, and the size of the gap is in the range of about 200 to 250 mils.

Claim 36. (new) The CMP apparatus of Claim 33, wherein the light source is a light emitting diode which emits light at a wavelength of about 880 nm.

Claim 37. (new) The CMP apparatus of Claim 26, wherein the materials on the surface of the wafer are any one of, or a combination of, conductive, insulating or barrier materials.

Claim 38. (new) The CMP apparatus of Claim 36, wherein the materials may be patterned on the surface of the wafer.

Claim 39. (new) The CMP apparatus of Claim 26, wherein the sensor scans through the center of the wafer.

Claim 40. (new) The CMP apparatus of Claim 26, wherein the wafer axis and/or the platen axis are translatable in a direction perpendicular to the axes such that the platent axis and wafer axis are moved relative to each other with a non-zero sweeping velocity.

Claim 41. (new) A method of chemical mechanical polishing (CMP) of a semiconductor wafer in a CMP machine, comprising the steps of:

urging a polishing pad against the semiconductor wafer carried on a wafer carrier, the wafer carrier having multiple chambers that allow for independently varying pressure within the chambers that urge against a wafer at corresponding localized zones on the wafer;

scanning a sensor across the surface is a pattern that comprises a plurality of loci;

collecting a surface reflectance datum from the sensor at each of a plurality of points along each loci;

mapping the surface reflectance data to the localized zones;

characterizing the condition of the surface in each of the localized zones based on one or more statistical analyses of the data mapped to each localized zone; and

independently adjusting the pressure within one or more of the chambers responsive to the surface condition within each of the corresponding localized zones.

Claim 42. (new) The method of Claim 41, wherein the step of independently adjusting further comprises:

reducing or stopping the chemical mechanical polishing independently within each localized zone when the statistical measures indicate a change in the surface condition in that zone.

Claim 43. (new) The method of Claim 42 wherein the chemical mechanical polishing is reduced or stopped in a zone when one or more of the standard deviation, the standard deviation to mean ratio, and the range of the surface reflectance data within a localized zone indicate the onset of an endpoint.

Claim 44. (new) The method of claim 42, wherein the chemical mechanical polishing is reduced or stopped in a localized zone when the change in reflectance in that zone exceeds a predetermined threshold value.

Claim 45. (new) The method of Claim 41, wherein the step of independently adjusting further comprises:

reducing or stopping the chemical mechanical polishing, independently within each localized zone according to the one or more statistical measures wherein the statistical measures are selected from the mean, standard deviation, variance, range and ratios or other mathematical combinations thereof, of the surface reflectance data mapped to the localized zone.

Claim 46. (new) The method of Claim 41 further comprising:

calculating the variance in the surface reflectance data;

determining the degree of topographical variations in the surface reflectance data on the surface of the wafer based on the variance of the data at the localized zones; and

controlling the polishing process at the localized zones on the wafer responsive to the topographical variations.